

# The Effect of Aromatherapy of Cardamom on Chemotherapy Induced Nausea and Vomiting Among Cancer Patients

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## ABSTRACT

Chemotherapy is one of the therapies for cancer patients with side effects of nausea and vomiting. Nausea and vomiting experienced by the patient can be a new problem and cause a decrease in health. Aromatherapy is a therapy that can reduce nausea and vomiting. This study aimed to determine the effect of cardamom (cardamom) aromatherapy on nausea and vomiting in cancer patients with chemotherapy. This study used a quasi-experimental research design with a pretest-posttest control group design approach consisting of 17 treatment groups (intervention) and 17 control groups. The sampling technique used was simple random sampling. Data collection using the INVR (The Rhodes Index for Nausea, Vomiting, and Retching) questionnaire and observations during the assessment. Data analysis used paired sample t-test and independent sample t-test. The study result showed an effect of cardamom aromatherapy on nausea and vomiting in cancer patients with chemotherapy (p-value= 0.001). There was also a significant difference in the mean score of nausea and vomiting in both intervention and control groups (p-value= 0.007). This study concludes that cardamom aromatherapy affects changes in nausea and vomiting in cancer patients with chemotherapy.

**Keywords:** Chemotherapy-induced nausea and vomiting, Complementary therapy, Cardamom essential oil, Cancer.

## 1. INTRODUCTION

The incidence of chemotherapy-induced nausea and vomiting is the most problematic side effect for patients. At the same time, the treatment of CINV has continued to develop in recent years, especially with antiemetic agents or CINV prophylaxis [1], [2]. However, previous studies reported that 40% of cancer patients still had CINV [3].

Study from Chan et al., stated that the incidence of CINV was 83.3% nausea and 78.9% vomiting (Chan). This statement is in line with the previous research presented that the percentage of nausea in chemotherapy patients is 60% and vomiting 36% [4].

When patients have chemotherapy-induced nausea and vomiting, they will experience one of the following phases: acute, delayed, anticipatory, breakthrough, and refractory. The acute phase begins within 1 to 2 hours of

chemotherapy and peaks within 4 to 6 hours. Delayed emesis occurs more than 24 hours after chemotherapy. The anticipatory phase occurs before chemotherapy in response to the patient's nausea and vomiting during previous chemotherapy [4].

Untreated CINV will cause other problems for patients, including nutritional disorders, dehydration, electrolyte disturbances, decreased psychological and physiological functions. In the long term, CINV can affect chemotherapy delay, chemotherapy non-adherence, and the patient's quality of life [5].

Various problems can occur in cancer patients who have CINV. It is a challenge for health workers to help patients deal with CINV. Various studies have been conducted to determine the effectiveness of both pharmacological and non-pharmacological therapies.

Pharmacological therapy is still the primary choice to treat nausea and vomiting-induced chemotherapy. The drugs given are antiemetic, antihistamine and corticosteroid. Drugs are given before chemotherapy, aiming as a premedication [6]. However, some patients still experience the acute phase of CINV, which complaints of nausea and vomiting during the chemotherapy process. Based on a study conducted at Moewardi Hospital, it was found that more than 50% of cancer patients still had CINV even though they had been given premedication.

Therefore, non-pharmacological therapy can be a complementary or supporting therapy during the chemotherapy process. Complementary therapies applied in previous studies are relaxation, guided imagery, music therapy, distraction or hypnosis techniques, acupuncture, Transcutaneous Electrical Nerve Stimulation (TENS), and aromatherapy [7], [8].

Aromatherapy is a type of non-instructive therapy, does not cause injury, is practical and easy to do. Aromatherapy usually uses essential oils whose application is inhaled, applied topically, for bathing, and as perfume. The mechanism of action of aromatherapy is through circulation and the respiratory system [8].

Several types of aromatherapy that can reduce nausea and vomiting include ginger, chamomile, peppermint, spearmint, cardamom [8]. Cardamom contains 3-7% essential oil in which there are cineol, borneol, and terpineol, which are efficacious to reduce nausea and vomiting.

The current study aimed to determine the effect of cardamom aromatherapy on cancer patients who had chemotherapy-induced nausea and vomiting.

## 2. METHODS

This study uses quasi-experimental research through pretest-posttest design with a control group approach. The pretest-posttest control group design involved two subjects, the intervention group given aromatherapy and the control group given routine therapy. The inclusion criteria in this study were cancer patients who received chemotherapy, experienced CINV, were willing to be given cardamom aromatherapy. Exclusion criteria were patients with unstable hemodynamic conditions, uncooperative, allergic to cardamom.

This research was conducted after obtaining permission from the medical research ethics committee from dr. Moewardi Surakarta, Indonesia. Respondents were given a detailed explanation regarding the benefits and objectives of the study, then filled out an informed concern prior to the research. Confidentiality of patient data was maintained in this study.

The sampling technique used simple random sampling with a random method using coins.

The Rhodes Index for Nausea, Vomiting, and Retching (INVR) is a questionnaire used to collect data on nausea and vomiting. The INVR questionnaire is a valid and reliable measuring instrument with an R-value of 0.63 and Cronbach's alpha 0.907. The INVR consists of 8 questions about nausea, vomiting, and nausea with the components of frequency, amount, duration, severity, and perceived difficulty of each symptom for 24 hours.

Seventeen respondents in the intervention group filled out the INVR questionnaire as a pre-test score. The pre-test was carried out for 1 hour of chemotherapy. Then respondents were given cardamom aromatherapy 3 times for 10 minutes each. In the first session, aromatherapy was given at 7 hours of chemotherapy administration. In the second session, an intervention was given 2 hours from the administration of the first therapy. The third session was given 2 hours from the administration of the second therapy. The final stage is collecting post-test data. Respondents are asked to fill out a questionnaire 1 hour after the last intervention. Cardamom aromatherapy is given to patients by dripping 3 drops on the mask worn by the patient.

The control group of 17 respondents was given the INVR questionnaire, which was filled out independently as a pre-test score. Post-test was conducted with the same period in the intervention group.

Data were analysed using a computer program. Both groups used descriptive analyses such as frequency, percentage, mean, and standard deviation to identify respondent characteristics and average nausea and vomiting scores before and after therapy. Analysis using paired t-test was used to determine the effect of cardamom aromatherapy on nausea and vomiting scores. Meanwhile, an independent t-test was used to determine the difference in the reduction in nausea vomiting scores in the intervention and control groups.

## 3. RESULTS

Characteristics of respondents consist of gender, age, education level, chemotherapy regimen, chemotherapy cycle. The characteristics of the two groups, intervention and control, did not have a significant difference. So it can be assumed that the two groups are homogeneous (Table 1).

The data shows that the description of the characteristics of respondents according to gender in the treatment group (intervention), which occupies the

**Table 1.** Demography Data

Variables	Intervention Group		Control Group		P-Value
	n	%	n	%	
<b>Age</b>					
12-25 yo	2	11.8	2	11.8	0.29
26-45 yo	3	17.6	1	5.9	
46-65 yo	12	70.6	14	82.4	
<b>Gender</b>					
Men	6	35.3	4	23.5	0.279
Women	11	64.7	13	75.5	
<b>Education Level</b>					
Compulsory Education	8	47.1	10	58.8	0.906
Secondary School	9	52.9	7	41.2	
<b>Emetogenic level of chemotherapy regimen</b>					
High	5	29.4	6	35.3	0.523
Moderate	10	58.8	10	58.8	
Low	2	11.8	1	5.9	
<b>Chemotherapy cycle</b>					
First (1-3x)	13	76.5	11	64.7	0.661
Advanced (4-6x)	4	23.5	6	35.3	

highest level of distribution, namely female as many as 11 respondents (64.7%) and the lowest distribution is male with 6 respondents (35.3%). In comparison, the control group that occupies the highest distribution level is female, with 76.5% (13 respondents).

The level of education in the two groups did not significantly differ. Both the intervention and control groups had almost the same proportion between compulsory education and further education.

The description of the emetogenic level of chemotherapy regimens in the two groups did not have a significant difference. More than 50% of the total respondents in both groups received chemotherapy regimens with moderate emetogenic levels.

The chemotherapy cycles in both groups had the same homogeneity. Most of the respondents in both the intervention and control groups were in the initial cycle of chemotherapy, i.e., 1-3 times of chemotherapy.

Table 2 shows respondents' average nausea and vomiting score (intervention group and control group) before and after being given the intervention.

Nausea and vomiting scores before intervention in both groups were normally distributed ( $P > 0.05$ ). Nausea and vomiting scores in the intervention and control groups were  $13.88 \pm 6.44$  and  $14.06 \pm 6.78$ , respectively.

Based on the data analysis that has been carried out, it was found that there was a significant difference in nausea and vomiting scores in the intervention group ( $p$ -value = 0.001) before and after being given cardamom aromatherapy. It can be said that cardamom aromatherapy has a significant effect on nausea and vomiting scores.

The control group that was given routine therapy also experienced a significant difference in nausea and vomiting scores ( $p$ -value = 0.018). However, the delta means score for nausea and vomiting in the intervention group was more significant (7.58) than the control group (1.72).

#### 4. DISCUSSION

##### *Respondent characteristics*

The distribution of sex frequencies in both study groups showed that most of the respondents experiencing nausea and vomiting were women. Kholida, et al. explained that women experience a higher prevalence of nausea and vomiting than men. It is in line with the statement of a study conducted by Hariyanto, et al., which states that nausea and vomiting ratio between women and men is 30%: 20%. The high level of nausea and vomiting is caused by fluctuations in the hormone estrogen that responds to dopamine receptors [9]. Estrogen can change neurotransmitters, which trigger the release of serotonin or 5-hydroxytryptamine (5-HT), substance P (SP), and dopamine, causing nausea and vomiting. It shows that women are more likely to experience nausea and vomiting when compared to men. In women, there are changes in reproductive hormones that affect the neurotransmitter system and the response of the vomiting center [10].

Furthermore, in this study, the age distribution of respondents in the treatment and control groups showed that the majority who suffered from nausea and vomiting of chemotherapy were elderly patients with an age range of 45-65 years. Amalia, et al. explained that nausea and vomiting could be experienced from various ages, but in

**Table 2.** Demography Data

Group	Value			
	Mean ± SD	t-hitung	Delta mean	p-value
Intervention Group				
Pre-test	13.88 ± 6.44	6.091	7.59	0.001
Post-test	6.29 ± 4.92			
Control Group				
Pre-test	14.06 ± 6.78	2.640	1.71	0.018
Post-test	12.35 ± 7.22			

the age range of 46-55 years, as many as (41.7%) of 76 respondents experienced severe nausea and vomiting [11]. It is associated with the response mechanism of the elderly body, which is more easily exposed to these chemotherapy agents. In addition, Chan and Yeo also explained that one factor affecting the level of nausea and vomiting is the patient's age [12].

Most of the respondents from the two groups received a moderate emetogenic regimen. In this study, some drugs are combined with a role for chemotherapy, so combined or single regimens can also influence that increase. This study's results follow the statement expressed by Peoples that a combination of chemotherapy regimens can increase the emetogenicity of drugs [13]. Another study from Grove et al. showed that almost 87% of respondents who experience nausea and vomiting receive drugs classified as moderately emetogenic [14]. So even though the chemotherapy regimen is classified as moderate, because of the interaction between the drugs given, it can increase emetogenicity.

The last distribution that was observed and studied was the chemotherapy cycle. In this study, the results showed that the majority of the two groups experienced nausea and vomiting undergoing the initial chemotherapy cycle. Generally, chemotherapy cycles affect nausea and vomiting experienced by patients. Another study from Grunbreg stated that the amount of nausea and vomiting experienced by patients depends on the chemotherapy cycle [15]. The longer the chemotherapy cycle, the higher nausea, and vomiting. However, in this study, different results were obtained from these studies. It means that the level of nausea and vomiting is not all influenced by the chemotherapy cycle that the patient has undergone. Research conducted by Dibble identified that respondents who experienced nausea and vomiting were in the second and third cycles [16]. These results are influenced by the individual's perception of the drug therapy. The more chemotherapy drugs are given, the more people become accustomed to the treatment. From this explanation, it can be concluded that the chemotherapy cycle affects nausea and vomiting. However, there is also a role in perceiving the drug being administered.

***Effect of Cardamom Aromatherapy on Chemotherapy-induced Nausea Vomiting Score***

The study results showed that the effect of giving cardamom aromatherapy was nausea and vomiting in cancer patients in the intervention group.

Nausea and vomiting due to chemotherapy occur through a complex process that involves communication between several neurotransmitters and receptors in the central nervous system and digestive tract. Two mechanisms play a role in CINV conditions, the central and peripheral pathways. Central pathways involving neurokinin-1 in the brain will cause late-onset of CINV, whereas peripheral pathways related to the gastrointestinal tract will be activated in the first 24 hours after chemotherapy associated with acute emesis. The neurotransmitters serotonin, neurokinin-1, and dopamine together with all their receptors play a role in stimulating emesis. These neurotransmitters are the main targets of antiemetic therapy [6].

Besides, vomiting can also be caused by activating the Chemotherapy Trigger Zone (CTZ). The CTZ interacts directly with substances in the blood and can also be triggered by signals from the stomach and intestines travelling along afferent vagal nerves. The chemoreceptors are located outside the blood-brain barrier. It can be directly activated by the presence of an emetogenic component, chemotherapeutic agents [17].

In this study, Java Cardamom (*Amomum compactum*), which is used as aromatherapy, is a native Indonesian spice that the public can commonly use as a spice in cooking. So that the Indonesian people widely know the aroma of the java cardamom.

Java cardamom belongs to the Zingiberaceae family. The active components identified in Javanese cardamom essential oil 98% of the total oil consisted of 1.8 cineole (38.7%), pinene (13.6%), terpineol (12.6%), spathulenol (8.3%), 4-terpineol (4.5%), germacrene D (3.0%), pinene (2.8%) and selinene (2.7%). Javanese cardamom also contains alkaloids, tannins, amino acids, protein saponins [18].

Aromatherapy is a therapy that is easy to give and causes injury [19]. Aromatherapy used in this study is an essential oil applied by inhalation with a mask media. When inhaling aromatherapy, molecules containing aromatic elements will evaporate and reach the patient's nose. On the nose, there are vibrating hairs that function as receptors that will deliver these signals to the central nervous system. These signals cause the central nervous system to release serotonin and endorphins that connect the nervous system and body to ensure the desired changes [20]. In the current study, aromatherapy comes from cardamom, which contains substances to reduce nausea and vomiting, namely a combination of essential oils, cineol, borneol, terpineol.

The control group also experienced changes in nausea and vomiting scores before and after routine therapy from the hospital. However, the mean score between the pre-test and post-test in the two groups had a significant difference. The intervention group given cardamom experienced more tremendous changes in nausea and vomiting than the control group, which was given routine therapy.

The same results were also carried out by the research of Khalili, which stated that the severity of nausea and vomiting in chemotherapy patients with cardamom (cardamom) aromatherapy intervention was more significant than placebo with  $p < 0.01$  [21]. It can prove that the aromatherapy compound cardamom can reduce chemotherapy-induced nausea and vomiting.

Darmawan explained that gastrointestinal toxicity (anorexia, nausea, vomiting) is often complained of by patients with chemotherapy [22]. However, it is more as a physiological process of the body to rid itself of toxic substances. So it depends on each - each body is also in compensation for the level of nausea and vomiting experienced. In addition, according to research by Remesh, the dose of chemotherapy drugs given also affects the side effects experienced by chemotherapy patients [23]. Therefore, it can be concluded that the change in the score of nausea and vomiting experienced by the control group given chemotherapy was influenced by the body's physiological compensation and the dose given to each patient.

## 5. CONCLUSION

Changes in nausea and vomiting after the intervention is one form of success in non-pharmacological management. Nausea and vomiting are felt by patients undergoing chemotherapy, making nurses have to be willing and able to approach them by exploring the complaints felt by patients and helping to solve existing problems. It is part of the nurse's role

## AUTHOR'S CONTRIBUTIONS

TD.H, A.N.D Conceived of the presented data  
D.H, A.N.D, P.P Wrote the manuscript  
F.N.R verified the analytical methods

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